

What is claimed is:

1. An apparatus for performing a hydroforming operation, comprising:
a stationary base;
a ram linearly displaceable relative to the base;
5 a platen located between the base and the ram;
a first die supported on the ram and platen;
a second die supported on the platen and base; and
means secured to one of the base and the ram, for displacing the platen relative
to the base.
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2. The apparatus of claim 1 wherein the displacing means includes:
a pin secured to the ram, the pin including a first portion that moves through a
predetermined distance relative to the platen without engaging the platen, and a second
portion that releasably engages the platen for displacement with the ram.
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3. The apparatus of claim 1, wherein the displacing means includes:
an actuator engaged with the ram and the platen, adapted to transmit to the
platen displacement of the ram relative to the base.
- 20 4. The apparatus of claim 1, wherein the displacing means includes:
an extendable and retractable actuator engaged with the ram and the platen,
adapted to produce a force tending to displace the platen relative to the base.
5. The apparatus of claim 1, wherein the displacing means includes:
25 a linearly extendable and retractable actuator engaged with the base and the
platen, adapted to produce a force tending to displace the platen relative to the base.
6. The apparatus of claim 1, wherein the first die and the second die each
include a pair of die sections having respective recesses formed therein that cooperate

to define a die cavity when said die sections engage one another, said die cavities adapted to receive respective workpieces therein; and

further including means for supplying pressurized fluid within each of said dies cavities, the pressurized fluid adapted to expand the workpieces into conformance

5 with the respective die cavities.

7. The apparatus of claim 1 wherein the first die includes first and second die sections and the second die includes first and second die sections.

10 8. The apparatus of claim 7 wherein said first die section of said first die is engaged by the ram and said second die section of said second die is engaged by the base.

15 9. The apparatus of claim 7 wherein said first die section of said first die is engaged by the ram platen, the second die section of said first die is engaged with the first die section of said second die, and the second die section of said second die is engaged by the base.

20 10. The apparatus defined in claim 7 wherein the second die section of said first die and said first die section of said second die are supported on the platen.

11. The apparatus defined in claim 7 wherein said second die section of said first die and said first die section of the second die are formed integrally with one another.

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12. An apparatus for performing a hydroforming operation comprising:
a stationary base;
a ram linearly displaceable relative to the base;
a first platen secured to the ram for displacement with the ram;

a second platen located between the base and the ram, having an opening extending through a thickness of the second platen;

a first die supported on the first platen and the second platen;

a second die supported on the second platen and the base; and

5 a pin secured to the first platen, including a shank extending from the first platen through the opening on the second platen, and a head secured to the shank, located at an opposite side of the second platen from the location of the first platen, and adapted to engage the second platen.

10 13. The apparatus of claim 12, wherein the base has an opening sized to receive the head therein and to guide displacement of the head relative to the base.

14. The apparatus of claim 12, wherein the second platen has an opening sized to receive the shank therein and to guide displacement of the shank relative to
15 the second platen without engaging the second platen.

15. The apparatus of claim 12, wherein the shank has a predetermined length extending between the first platen and the head, the length corresponding to a distance in which the first die opens.

20 16. The apparatus of claim 12, wherein the displacing means includes:
a linear actuator engaged with the ram and the platen, adapted to transmit to the platen displacement of the ram relative to the base.

25 17. The apparatus of claim 12, wherein the displacing means includes:
a linear extendable and retractable actuator engaged with the ram and the platen, adapted to produce a force tending to displace the platen relative to the base.

18. The apparatus of claim 12, wherein the displacing means includes:

a linearly extendable and retractable actuator engaged with the base and the platen, adapted to produce a force tending to displace the platen relative to the base.

19. The apparatus of claim 12, wherein the first die and the second die each
5 include a pair of die sections having respective recesses formed therein that cooperate to define a die cavity when said die sections engage one another, said die cavities adapted to receive respective workpieces therein; and

further including means for supplying pressurized fluid within each of said dies cavities, the pressurized fluid adapted to expand the workpieces into conformance
10 with the respective die cavities.

20. The apparatus of claim 12, wherein the first die includes first and second die sections and the second die includes first and second die sections.

15 21. The apparatus of claim 20, wherein said first die section of said first die is engaged by the first platen, and the second die section of said second die is engaged by said the base.

22. The apparatus of claim 20, wherein said first die section of said first die
20 is engaged by the first platen, the second die section of said first die is engaged with the first die section of the second die, and the second die section of the second die is engaged with the base.

23. The apparatus defined in claim 20, wherein the second die section of
25 said first die and said first die section of said second die are supported on the second platen.

24. The apparatus defined in claim 20, wherein said second die section of said first die and said first die section of the second die are formed integrally with one another.

5 25. A method for moving dies used for hydroforming workpieces, comprising the steps of:

- providing a stationary base and a ram linearly displaceable relative to the base;
- providing a platen located between the base and the ram;
- supporting a first section of a first die on the ram and a second section of the
- 10 first die on a platen located between the base and the ram;
- supporting a first section of a second die on the platen and a second section of the second die on the base;
- displacing the ram relative to the platen and base a distance in a first direction sufficient to open the first die; and
- 15 subsequently displacing the ram relative to the base an additional distance in the first direction sufficient to open the second die.

26. The method of claim 25, further comprising the steps of:

- inserting a workpiece in each of the dies;
- 20 closing the dies by displacing the ram in a second direction opposite the first direction; and
- supplying pressurized fluid within each of the workpieces to conform each workpiece to the surface of the respective die.

25 27. A method for moving dies used for hydroforming workpieces, comprising the steps of:

- providing a stationary base and a ram linearly displaceable relative to the base;
- providing a platen located between the base and the ram and engageable with the ram;

supporting a first section of a first die on the ram and a second section of the first die on the platen;

supporting a first section of a second die on the platen and a second section of the second die on the base;

5 displacing the ram and the platen relative to the base a first distance in a first direction sufficient to partially open the first die and the second die;

displacing the platen toward the ram a second distance in the first direction sufficient to open the second die; and

displacing the platen toward the base a distance in a second direction opposite
10 the first direction sufficient to open the first die.

28. The method of claim 27, further comprising the steps of:

inserting a workpiece in each of the dies when the respective die is open;

closing the dies by displacing the ram in the second direction; and

15 supplying pressurized fluid within each of workpieces to conform each workpiece to the surface of the respective die.